

JOHN A. NYCHKA

Date of Birth: October 13, 1974

Canadian Citizen

EDUCATION

- 03/2004 **Ph.D.**, Materials, University of California Santa Barbara, CA, USA
- “*Quantifying Outward Cation Diffusion in Thermally Grown Alumina Scales*”, Advisor: Professor D.R. Clarke
 - Funded by the Office of Naval Research (ONR)
- 09/1999 **Master of Engineering**, Materials Science and Engineering, McMaster University, Hamilton, ON, Canada
- “*The Effects of Heat Treatment Conditions on a Microwave Sintered Silicon Nitride Ceramic*”, Advisor: Professor D.S. Wilkinson
 - Funded by the Natural Sciences and Engineering Research Council of Canada (NSERC) and MicroWear Corp.
- 05/1997 **Bachelor of Science**, Metallurgical Engineering, Awarded with Distinction and Co-op, University of Alberta, Edmonton, AB, Canada
- “*The Effects of Alloy Content on the Colour of Copper-Tin and Copper-Tin-Lead Bronzes*”, Advisor: Professor M.L. Wayman

ACADEMIC EXPERIENCE

- 08/2005-Present **Assistant Professor of Materials**, Chemical and Materials Engineering, University of Kentucky, Lexington
- Instructor: Introduction to Materials Science, Research in Materials Science, Independent work in Materials Engineering
 - Member of Materials Science and Engineering undergraduate, graduate, and faculty search committees
 - Responsible for undergraduate lab renovation: planning, equipment acquisition
 - Informal student instruction and advising, including student-faculty events, Materials Advantage chapter meetings
- 06/2005-07/2005 **Instructor**, Materials, University of California Santa Barbara
- Summer session: Introduction to Structure and Properties of Materials
- 04/2004-07/2005 **Post-Doctoral Researcher**, Materials, University of California Santa Barbara
- Responsibilities included design, manufacture, and testing of equipment to measure vibration damping response of turbine engine alloys and coatings at high temperature (~1000°C)
 - Performed calculations to define parameter space to aid in equipment selection
 - Mentored graduate students, and organized research group meetings
 - Other projects: Laser induced spallation and breakdown of oxide scales, and fracture mechanics of metal-ceramic interfaces
- 10/1999-04/2004 **Research Assistant**, Materials, University of California Santa Barbara
- Worked on numerous research projects in areas of thermal barriers coatings, Raman and luminescence spectroscopy, oxidation of metals, and stress and strain measurement techniques
 - Performed failure analysis and residual stress measurements in collaboration with domestic and foreign universities and industry
- 01/1997-05/1997 **Undergraduate Research Assistant**, Chemical and Materials Engineering, University of Alberta
- Performed materials characterization of bioceramic coatings on titanium alloys after *in vitro* leaching in order to select inert materials for implantation
 - Presented results in campus forum for the Dean of Engineering

INDUSTRIAL EXPERIENCE

- 05/1997-09/1997 **Research and Development Engineer**, MicroWear Corp., Fort Saskatchewan, Alberta, Canada
- Designed and built a prototype ceramics extruder for experimental testing
 - Performed mechanical testing and microstructural analysis of microwave sintered silicon nitride
 - Collaborated with Alberta Research Council in performing lab scale extrusion tests (D. Ghosh)
 - Presented results at the 1998 Canadian Ceramics Society Conference
- 05/1996-12/1996 **Co-op Student Researcher**, Westaim Corp., Fort Saskatchewan, Alberta, Canada
- Worked on developing green forming technologies for ceramics: green machining, tape casting
 - Evaluated mechanical behavior, green machinability, and microstructure of microwave sintered ceramics
 - Operated and helped improve efficiency of microwave sintering furnaces
- 01/1995-09/1995 **Co-op Student Researcher**, Gibraltar Mines Ltd., Williams Lake, British Columbia, Canada
- Conducted experiments in a feasibility study of copper oxide ore
 - Operated solvent extraction equipment; performed analytical chemical analysis in assay lab
 - Trained in safe industrial and laboratory practices along with waste and hazardous materials information systems
- 06/1994-09/1994 **Co-op Student Machinist**, Sage Fluid Control Ltd., Edmonton, Alberta, Canada
- Operated computer numeric controlled lathes to machine forged metal pieces in to components for oil pipelines
 - Adjusted computer programs to aid in machining of parts
 - Assessed parts for specification adherence and assembled products

TEACHING AND MENTORING EXPERIENCE

- 08/2005-Present **Instructor**, Chemical and Materials Engineering, University of Kentucky
- Introduction to Materials Science, Fall 2005, Spring 2006
 - Research in Materials Science, Spring 2006
 - Independent Work in Materials Engineering, Summer 2006
 - Mentored graduate student teaching and research assistants
- 06/2005-07/2005 **Instructor**, Materials, University of California Santa Barbara
- Introduction to Structure and Properties of Materials (MTRL 101), Summer 2005
 - Mentored graduate student teaching assistants in grading and teaching
- 10/1999-12/1999 **Teaching Assistant**, Materials, University of California Santa Barbara
- Materials in Engineering (Professor C.L. Levi)
 - Prepared weekly lectures for assisting students in assignments
 - Assisted in development of portions of assignments and answer keys
- 09/1997-05/1999 **Teaching Assistant**, Materials Science and Engineering, McMaster University
- Prepared weekly lectures for lab demonstrations (up to 5/week)
 - Prepared specimens and demonstrated labs to multiple sections:
 - Mechanical Behaviour of Materials (Professor D.S. Wilkinson)
 - Measurements and Communication: Chemical reaction by reaction product and Chemical analysis by atomic levels (Professors M.B. Ives, P.S. Nicholson, A. Petric)
 - Engineering Computation (Professor P. Smith)
 - The Crystalline Structure of Materials (Professor G.A. Irons)

- Developed Crystallography Laboratory Exercises: Powder Diffraction Pattern Analysis, Energy Dispersive X-Ray Analysis, Electron Diffraction
- Industry mechanical testing lab demonstration for Certificate Course in Metallurgy of Iron and Steel: hardness, Charpy fracture, and tensile testing (Professor J.D. Embury)

Since 2001

Mentor, Materials, University of California Santa Barbara

- Graduate students
 - Training of students on equipment
 - Aiding students in experimental design and data analysis
 - Imaging techniques
 - Paper reviewing

01/2003-09/2003

Mentor, Materials, University of California Santa Barbara

- Senior undergraduate Chemical Engineering mentee
 - Trained mentee in design of experiments, preparation of samples, operation of high temperature furnaces and luminescence spectrometer, time management, and technical poster presentation
 - Mentee won second place in the Engineering category for his poster in the Undergraduate Research Symposium

OTHER EXPERIENCE

03/2004

Visiting Researcher, Kagawa Lab, Institute of Industrial Science, University of Tokyo, Japan

- Research topics: high temperature optical reflectivity measurements of stabilized zirconia, luminescence spectroscopy, near field optical luminescence spectroscopy

09/2002-08/2003

Part Time Research Assistant, Psychology, University of California Santa Barbara

- Computer animated a cistern-type toilet flushing for use in testing subjects' abilities to understand and explain mechanical systems
- Repaired and maintained a surgical research laparoscope for use in testing motor coordination and spatial recognition

COMMUNITY SERVICE

02/2006

Volunteer Instructor, ASM Materials Engineering Instruction Course on Metallographic Techniques, SECAT, Lexington, KY

- Developed teaching materials and demos for lectures regarding metallographic specimen preparation and analysis
- Consulted with students regarding the setup of their metallurgical lab and particular processes and data analyses

06/2003

Volunteer Instructor, La Patera Elementary School, Goleta, CA.

- Worked with student teacher to develop demonstrations to comply with grade 6 science curriculum
- Prepared short seminar regarding size and scale for class of 30 students (also made accompanying scanning electron micrographs of insects as examples)
- Developed procedure and assisted students in making their own box camera obscura out of simple materials

03/2003

Volunteer Instructor, Hollister Elementary School, Goleta, CA.

- Led discussion on the states of matter in a grade 1 class of 18 students
- Developed and performed a demonstration on the states of matter –made dilatant non-Newtonian goo with the students

- 10/2001 **Volunteer**, New Student Orientation Discussion Panel, Graduate Student's Association, University of California Santa Barbara
- Sat on a panel of four graduate students who spoke and entertained questions from audience of incoming graduate students
- 1998-1999 **Volunteer Instructor**, *Let's Talk Science Partnership Program*, McMaster University, Canada
- Exposed students to the benefits and opportunities in science
 - Fostered students' perception of, and interest, in science
 - Developed a proficiency in communicating science to a broad audience
 - Demonstrated leadership, creativity, and organizational skills in designing and implementing hands-on activities to complement the Ontario Ministry of Education and Science and Technology Curriculum guidelines
 - Assisted elementary school teachers in teaching science curriculum
 - Developed and performed mechanics demonstrations with another graduate student for three grade 5 classes

ACADEMIC AWARDS

- 2006 **Nominee: Faculty of the Year Award**, The National Society of Collegiate Scholars, Washington, DC
- 2003 **Best Poster Award**, Engineering Conferences International: Thermal Barrier and Environmental Coatings Conference, Irsee, Germany
- 1999 **First Place Poster Award**, Canadian Ceramic Society Conference, Toronto, Canada
- 1997 **Viridian Scholarship in Metallurgy** Chemical and Materials Engineering, University of Alberta, Canada
- 1997 **Dean's Research Award**, Faculty of Engineering, University of Alberta, Canada
- 09/1998-09/1999 **Natural Sciences and Engineering Research Council of Canada Industrial Post-Graduate Scholarship**, Materials Science and Engineering, McMaster University, Canada

RESEARCH AREAS

Physical properties/processing of materials:

Coatings and thin films

- Catalysis/Fuel Cells
- Interface fracture mechanics
- Thermal barrier coatings
- Mechanical vibration damping coatings

Biomaterials/Biomimetics

- Dental Nanocomposites
- Bioglass/Bioceramics
- Coatings on implants
- Bone research

Metallic Alloy Design

- High temperature corrosion resistance
- Effect of composition and microstructure on color

Thermally Grown Oxides

- Morphology and physical properties

- Diffusion and growth rate kinetics

- Phase transformations

- Oxidation Synthesis

Hard Materials

- Silicon nitride and other ceramics and coatings

Characterization of materials:

- Optical, electron, atomic, and focused ion beam, microscopy

- Mechanical testing

- Spectroscopy: luminescence, optical reflectance, x-ray, secondary ion mass, mechanical, atomic absorption, and laser induced breakdown

Residual Stress Measurements

- Innovative experimental techniques

SOCIETY ACTIVITY

- 2006- **Chairman, Member**, American Society for Metals (ASM) Bluegrass Chapter
2006- **Life Member**, The Minerals, Metals & Materials Society (TMS)
2006- **Member**, The American Association for the Advancement of Science (AAAS)
2005- **Member**, National Association of Corrosion Engineers International (NACE)
- 2005- **Faculty Advisor**, Chemical and Materials Engineering Graduate Student Association, University of Kentucky
- 2000-2003 **Secretary**, Student Materials Society, University of California Santa Barbara
1992-1999 **Member, Engineer in Training**, The Association of Professional Engineers, Geologists and Geophysicists of Alberta, Canada (APPEGA)

Peer Reviewer for:

Materials Science and Engineering A
The Kentucky Journal of Excellence in College Learning and Teaching
International Journal of Adhesion and Adhesives

Conference Symposium Organizer

Materials Science & Technology, Detroit, September 16-20, 2007
Next Generation Biomaterials: Advanced Processing, Characterization, and Modeling of Materials for Medical Devices

COMPUTER SKILLS

- PC and Apple personal computers, Microsoft Office, Mathematica, KaleidaGraph, Imaging software
- Familiar with programming in Fortran and C, and interfacing equipment to run experiments

BIBLIOGRAPHY

Recent Refereed Papers

- M.M. Gentleman, V. Lugh, **J.A. Nychka**, and D.R. Clarke, "Non-contact Methods for Measuring Thermal Barrier Coating Temperatures," *International Journal of Applied Ceramic Technology*, **3** [2] (2006) 105-112
- J.A. Nychka**, T. Naganuma, M. Winter, Y. Kagawa, and D.R. Clarke, "Temperature Dependent Optical Reflectivity of Tetragonal-Prime Yttria-stabilized Zirconia," *Journal of the American Ceramic Society*, **89** [3] (2006) 908-913
- J.A. Nychka** and D.R. Clarke, "Quantification of Aluminum Outward Diffusion During Oxidation of Fe-Cr-Al Alloys," *Oxidation of Metals* **63** [5/6] (2005) 325-352
- J.D. Almer, G. A. Swift, **J.A. Nychka**, E. Üstündag, and D.R. Clarke, "In situ synchrotron measurements of oxide growth strains," *Materials Science Forum*, **490-491** (2005) 287-293
- J.A. Nychka**, M.Y. He, C. Pullen, and D.R. Clarke, "Surface Oxide Cracking Associated with Oxidation-Induced Grain Boundary Sliding in the Underlying Alloy," *Acta Materialia* **52** [9] (2004) 1097-1105
- J.A. Nychka**, T. Xu, D.R. Clarke, and A.G. Evans, "The Stresses and Distortions Caused by Formation of a Thermally Grown Alumina: Comparison Between Measurements and Simulations," *Acta Materialia* **52** [9] (2004) 2561-2568
- J.A. Nychka**, D.R. Clarke, S. Sridharan, E. Jordan, M. Gell, M.J. Lance, C.J. Chunnillall, I.M. Smith, S.R.J. Saunders, R. Pillan, V. Sergio, A. Selcuk, A. Atkinson, and K.S. Murphy, "NDE Assessment of TBCs: An Interim Report of a Photo-Stimulated Luminescence 'Round Robin' Test," *Surface and Coatings Technology* **163-164** (2003) 87-94

J.A. Nychka and D.R. Clarke, "Damage quantification in TBCs by photo-stimulated luminescence spectroscopy," *Surface and Coatings Technology* **146** (2001) 110-116

Conference Presentations

J.A. Nychka* and D.R. Clarke, "Aluminum Diffusion in Alumina Scales Grown on Fe-Cr-Al Alloys," *Presented at the International Conference on Metallurgical Coatings and Thin Films, San Diego, May 2, 2005*

J.A. Nychka*, D.R. Clarke, S. Sridharan, E. Jordan, M. Gell, M.J. Lance, C.J. Chunnillall, I.M. Smith, S.R.J. Saunders, R. Pillan, V. Sergo, A. Selçuk, A. Atkinson, and K.S. Murphy, "NDE Assessment of TBCs: An Interim Report of a Photo-Stimulated Luminescence 'Round Robin' Test," *Presented at the International Conference on Coatings and Metallurgical Thin Films, San Diego, 2002*

J. A. Nychka* and D.R. Clarke, "Damage Quantification in TBCs by Photo-Stimulated Luminescence Spectroscopy," *Presented at the International Conference on Coatings and Metallurgical Thin Films, San Diego, 2001*

J.A. Nychka*, P. Apté, "Green Forming of Silicon Nitride for Microwave Sintering Applications," *Presented at the Canadian Ceramic Society Annual General Meeting, Toronto, Ontario, Canada, February 17, 1998*

T. Naganuma, K. Matsumura, **J.A. Nychka**, D.R. Clarke, and Y. Kagawa*, "Interaction Between Visible-IR Wavelength Light and Y_2O_3 - ZrO_2 Thermal Barrier Coatings," *Presented at the 28th International Cocoa Beach Conference and Exposition on Advanced Ceramics & Composites, January 29, 2004*

G.A. Swift, E.Üstündag*, J.D. Almer, **J.A. Nychka**, and D.R. Clarke, "In-situ Investigation of Oxide Growth on a FeCrAlY Alloy," *Presented at the 28th International Cocoa Beach Conference and Exposition on Advanced Ceramics & Composites, January 29, 2004*

Poster Presentations

G. Gregori*, **J.A. Nychka**, L. Li and D.R. Clarke, "High Temperature Vibration Damping Measurements," *Presented at the Thermal Barrier Coatings MURI and NSF-EU Review, UC Santa Barbara, Santa Barbara, CA., USA, January 10-12, 2006.*

J.A. Nychka*, T. Naganuma, M.R. Winter, Y.Kagawa, and D.R. Clarke, "Temperature Dependent Optical Reflectivity of t -YSZ," *Presented at the Thermal Barrier Coatings MURI and NSF-EU Review, UC Santa Barbara, Santa Barbara, CA., USA, January 11-13, 2005*

J.A. Nychka*, D.R. Clarke, "High Temperature Vibration Damping Coatings," *Presented at the Thermal Barrier Coatings MURI and NSF-EU Review, UC Santa Barbara, Santa Barbara, CA., USA, January 11-13, 2005*

J.A. Nychka*, D.R. Clarke, "Quantifying Cation Grain Boundary Diffusion in Thermally Grown Alumina," *Presented at the Thermal Barrier Coatings MURI and NSF-EU Review, UC Santa Barbara, Santa Barbara, CA., USA, January 6-9, 2004*

J. A. Nychka*, D.R. Clarke, and J. Dryden, "Quantifying Cation Grain Boundary Diffusion in Thermally Grown Alumina," *Presented at the Engineering Conferences International Conference on Thermal and Environmental Barrier Coatings, Irsee, Germany, August 17-22, 2003*

J.A. Nychka*, D.R. Clarke, "Outward Cation Diffusion in Thermally Grown Alumina," *Presented at the Thermal Barrier Coatings MURI and NSF-EU Review, UC Santa Barbara, Santa Barbara, CA., USA, January 6-9, 2003*

J.A. Nychka*, D.S. Wilkinson, R. Roy, "Effects of Heat Treatments on the Mechanical Properties of a Microwave Sintered Silicon Nitride," *Presented at the Canadian Ceramic Society Annual General Meeting, Toronto, Ontario, Canada, 1999*

Invited Presentations

J.A. Nychka*, "The Role of Cation Diffusion in Alumina Scale Growth," *Presented at Oak Ridge National Laboratory to the Metals and Ceramics Division, Oak Ridge, TN, January 5, 2006*

J.A. Nychka*, "The Alumina Scale Growth Mechanism," *Presented at Wright-Patterson Air Force Base to the Materials and Manufacturing Directorate, Dayton, OH, December 1, 2005*

J.A. Nychka*, "Cation Diffusion in Thermally Grown Alumina Films"

- *University of British Columbia, Department of Metals and Materials Engineering, Vancouver, Canada, August 19, 2002*
- *National Research Council of Canada, Institute for Fuel Cell Innovation, Vancouver, Canada, August 21, 2002*

* Presenting author

SELECT RESEARCH COLLABORATIONS

University of Pittsburgh (PA), Prof. G.H. Meier: Oxidation studies of nickel superalloys; comparisons of residual stress measurement techniques: XRD and photostimulated luminescence spectroscopy (PSLS) on stainless steels, nickel superalloys, and nickel aluminate coatings

Howmet Castings and Alcoa Business(MI), K.S. Murphy: Measurements of residual stresses on thermal barrier coated (TBC) aluminate-coated superalloys by PSLS; failure analysis of different YSZ coatings

Institute of Industrial Science, University of Tokyo (Japan), Prof. Y. Kagawa: High temperature optical properties of TBCs; PSLS of thermally grown alumina scales